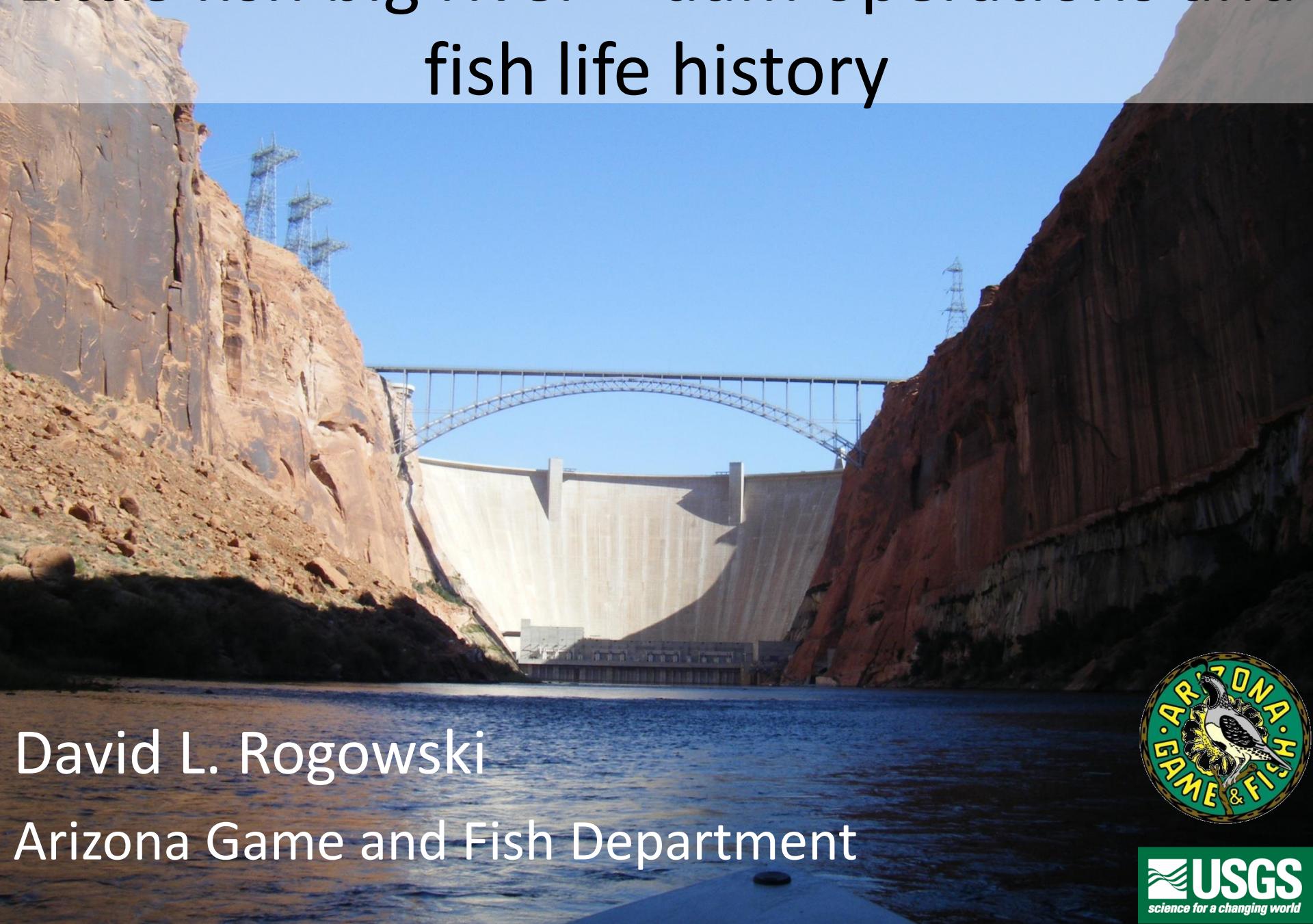


# Little fish big river – dam operations and fish life history

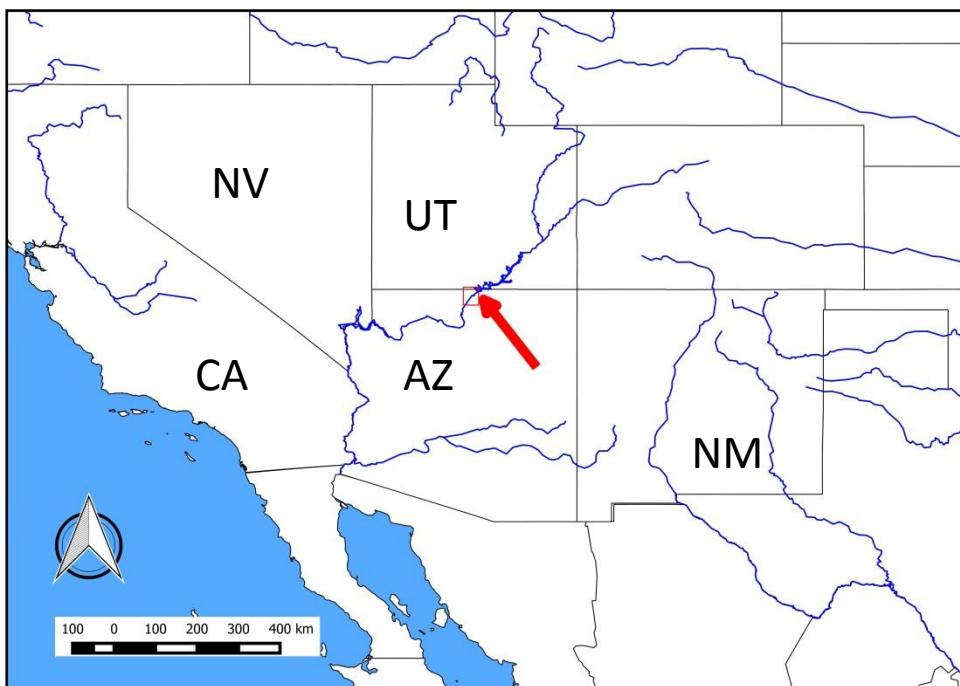


David L. Rogowski

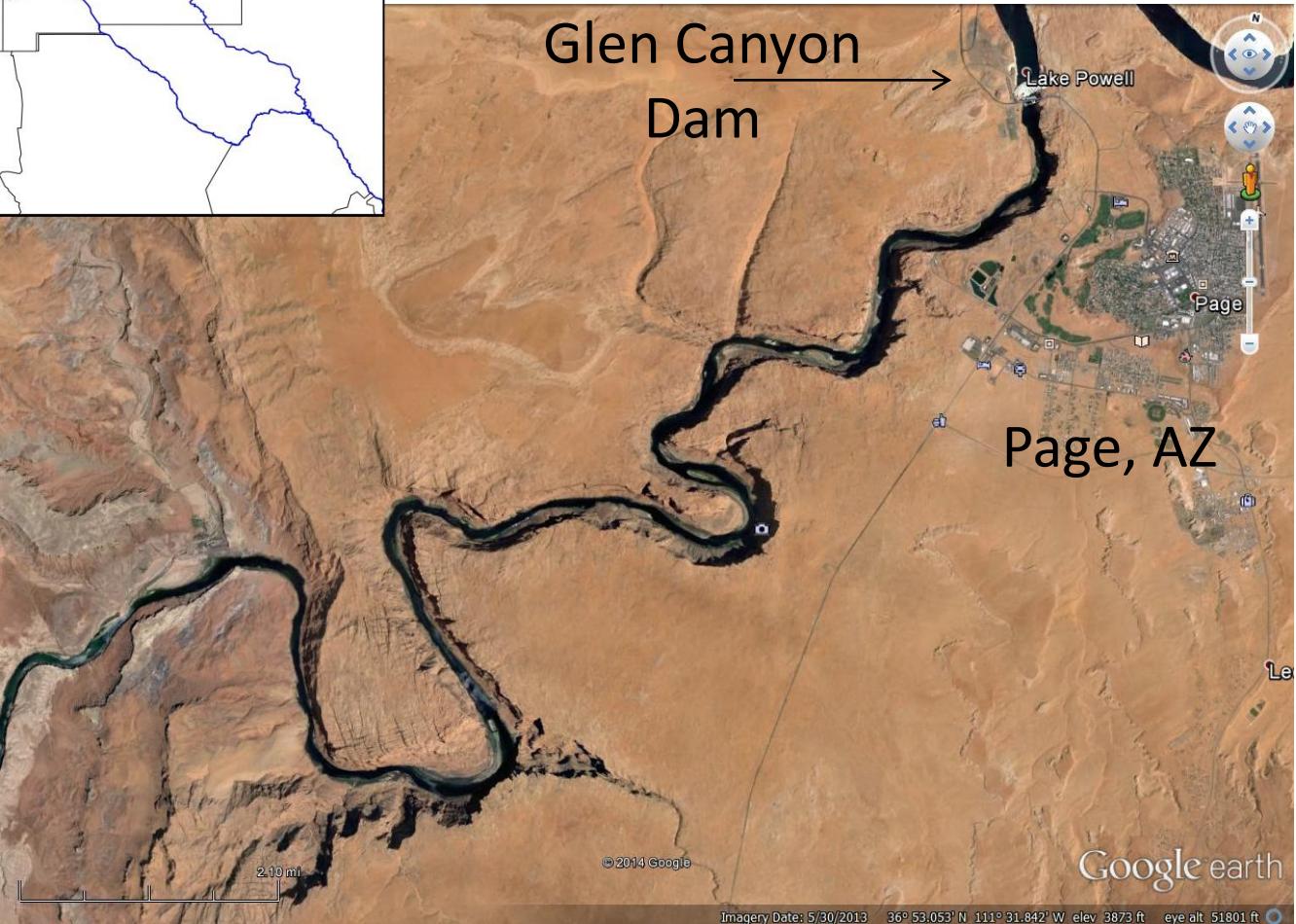
Arizona Game and Fish Department



# Lees Ferry fishery Colorado River (30 km)



Cold tailwater  
fishery Rainbow  
trout  
(*Oncorhynchus*  
*mykiss*)



Lees Ferry  
rainbow trout  
*Oncorhynchus*  
*mykiss*



OCT 6 -7 1982; Larry Sneith holds a 15-pound rainbow trout he took at Lee's Ferry.;  
Credit: Charile Meyers / Contributor



Average size  
rainbow trout  
currently  
(2000-2014)

<http://azwanderings.com/wp-content/uploads/Rainbow-3-1024x768.jpg>

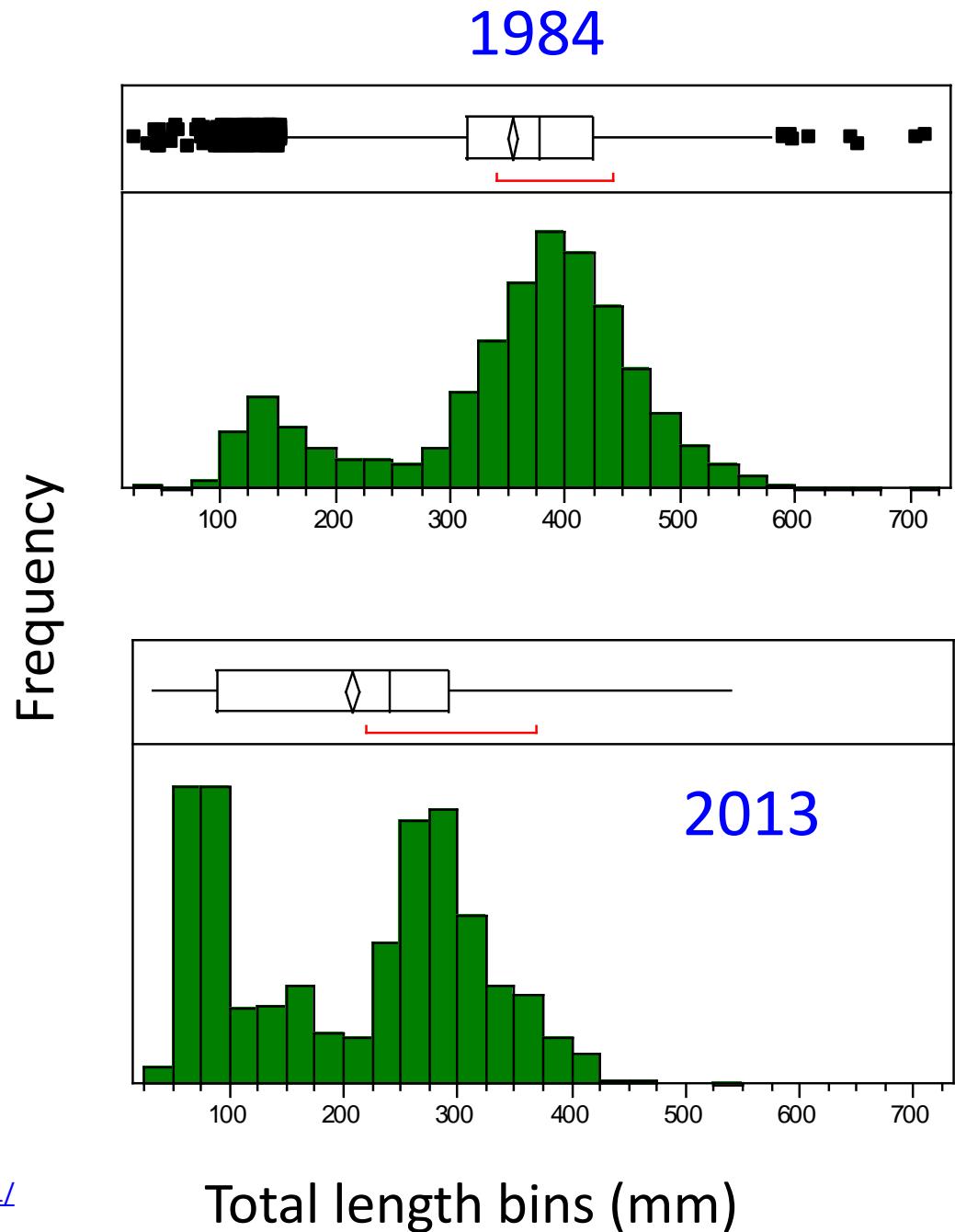


[http://azgfd.net/artman/uploads/1/Lees\\_Ferry\\_TROUT\\_1.JPG](http://azgfd.net/artman/uploads/1/Lees_Ferry_TROUT_1.JPG)

# Length Frequency histogram (electrofishing Fall)



<http://azwanderings.com/arizona-fly-fishing-lees-ferry-day-part-1/>



# Lees Ferry Sampling

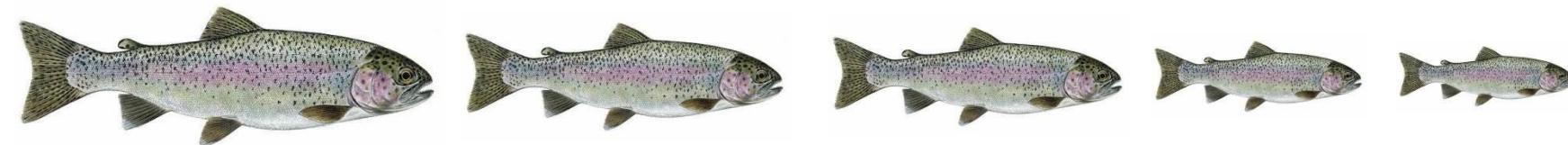
- Creel (angler) surveys year round
- Electrofishing: 3 trips (spring, summer, fall)
  - Stratified random sampling



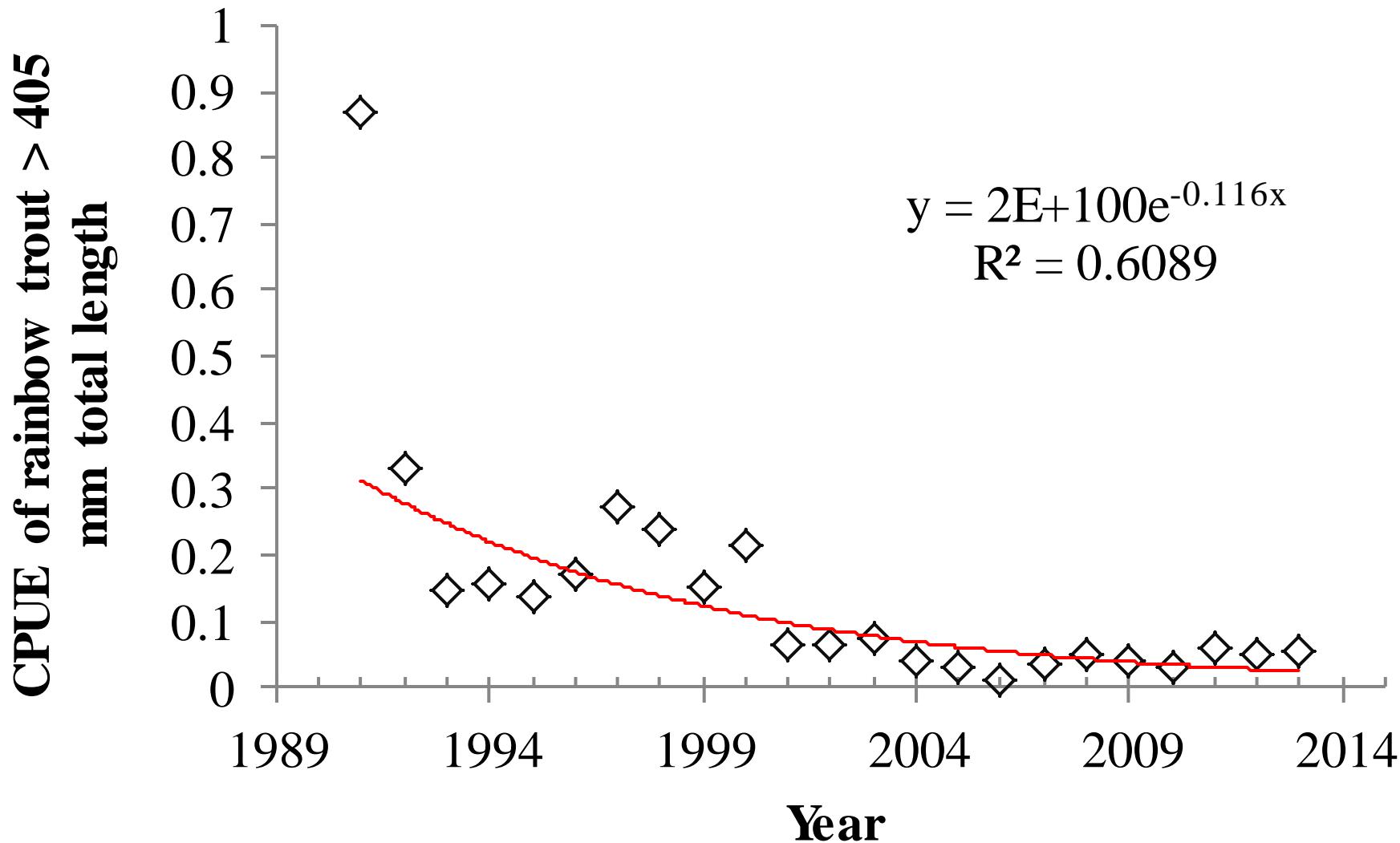
Photo. by Lisa Winters 2014

# Problem

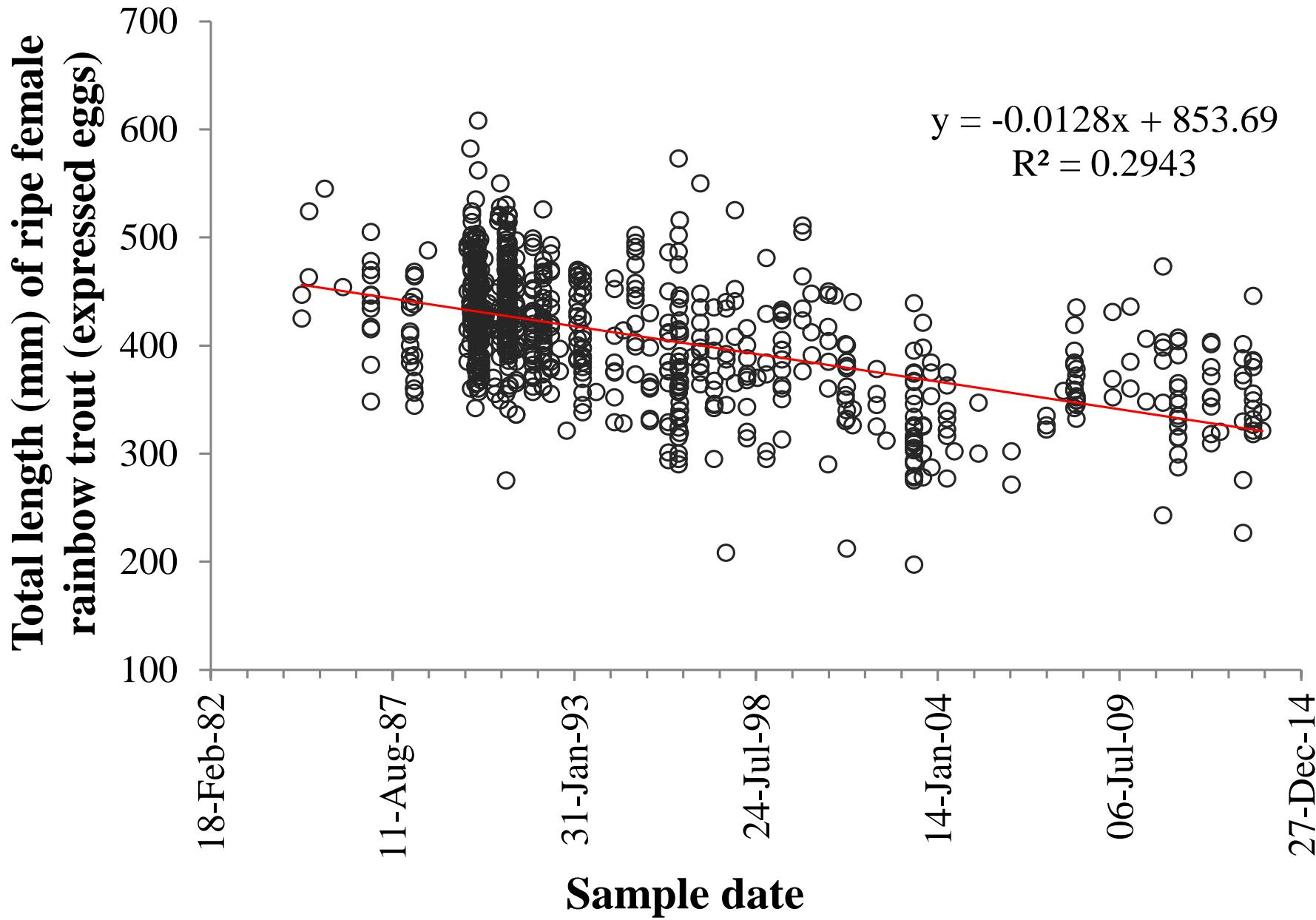
- larger fish were caught in the past – and not now, why?
  - Harvested (caught by fishermen: selected against)?
  - Natural mortality (disease, old age...)?
  - Density?
  - Lack of food?
  - Current rainbow trout strain grows slow?
  - Environmental factors (flow, ...)?



# Decline in catch per unit effort (CPUE) of rainbow trout > 405 mm

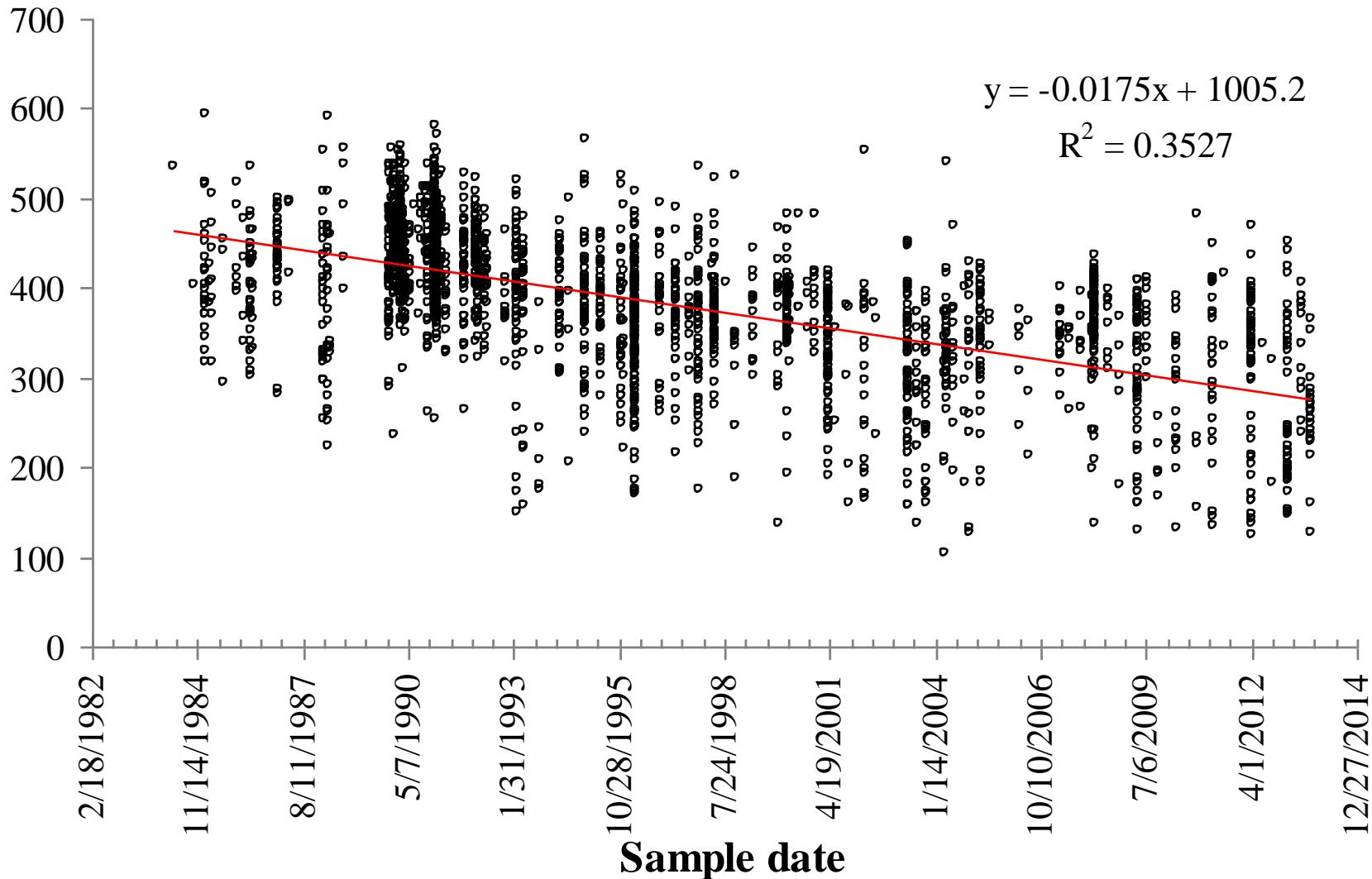


# Lees Ferry ripe female rainbow trout



# Lees Ferry ripe male rainbow trout

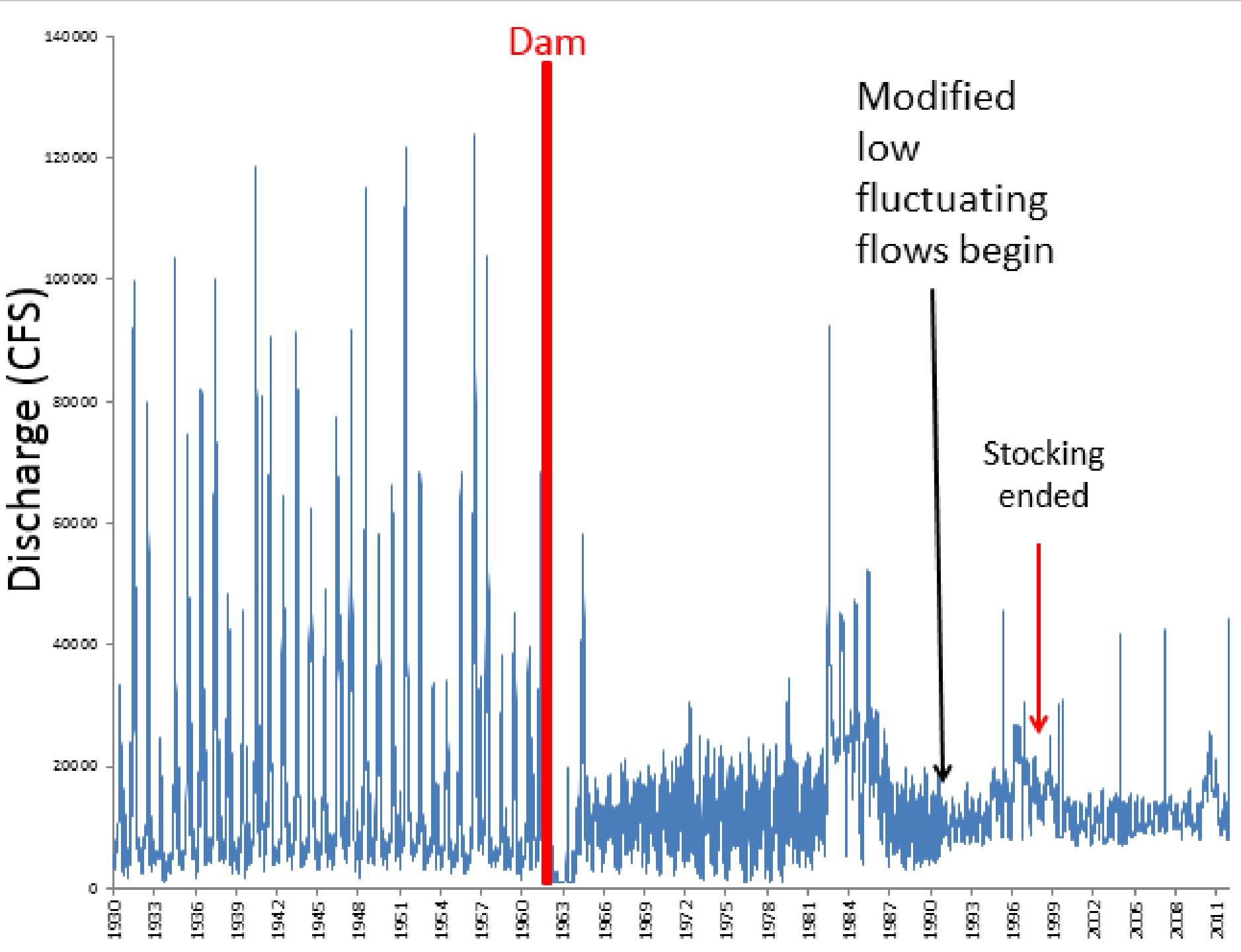
Total length (mm) of ripe male rainbow trout



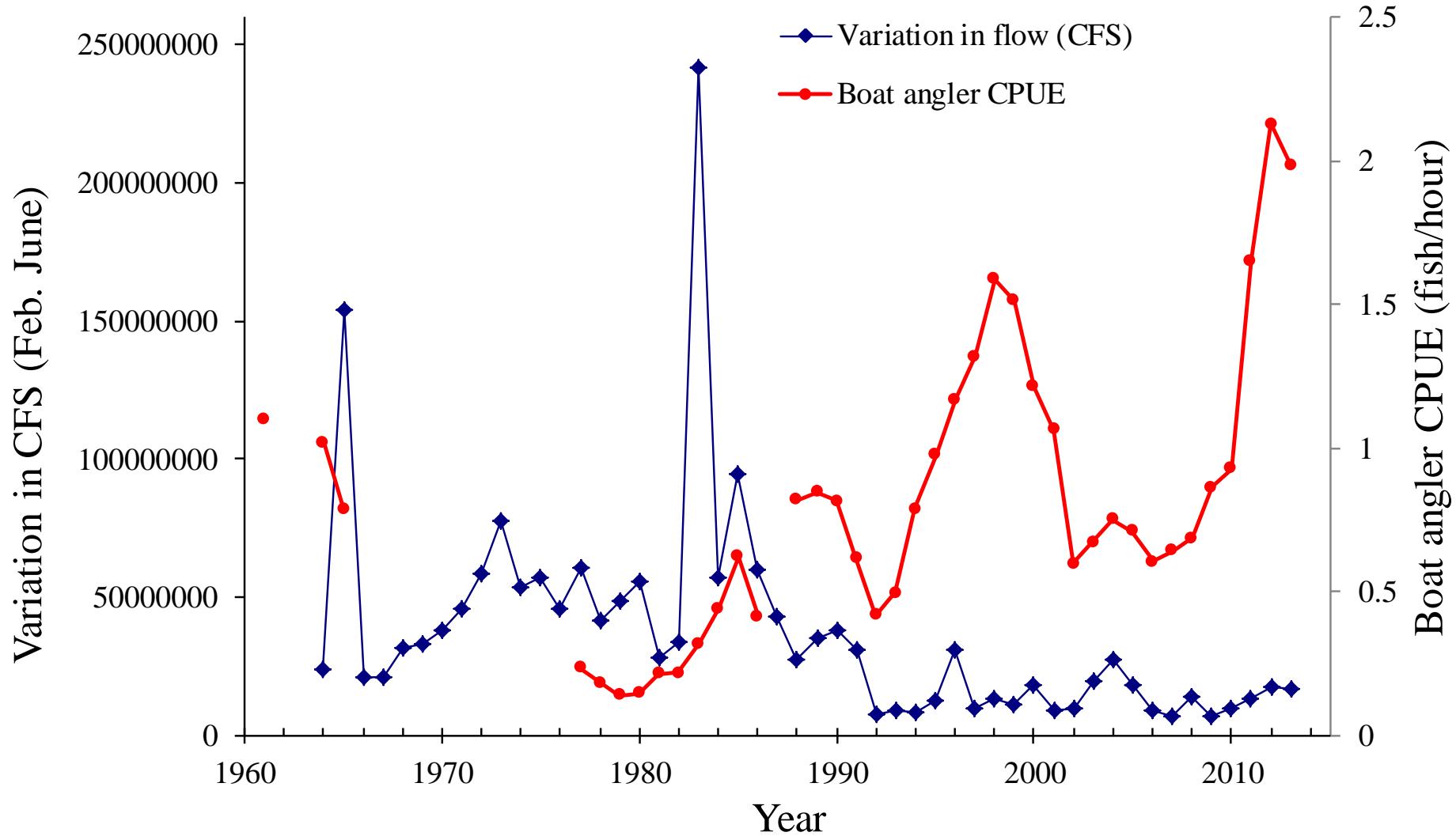
# Reasons for smaller reproductive size

- Smaller fish are more successful at Lees Ferry- Why?
  - **Food limited:** gain weight, length and reproduce.
  - **Selective advantage:** no benefit to delay maturation and grow to a large size
  - **Dam flow regime:** less variable than in past, steady consistent conditions allow for reproduction to occur every year

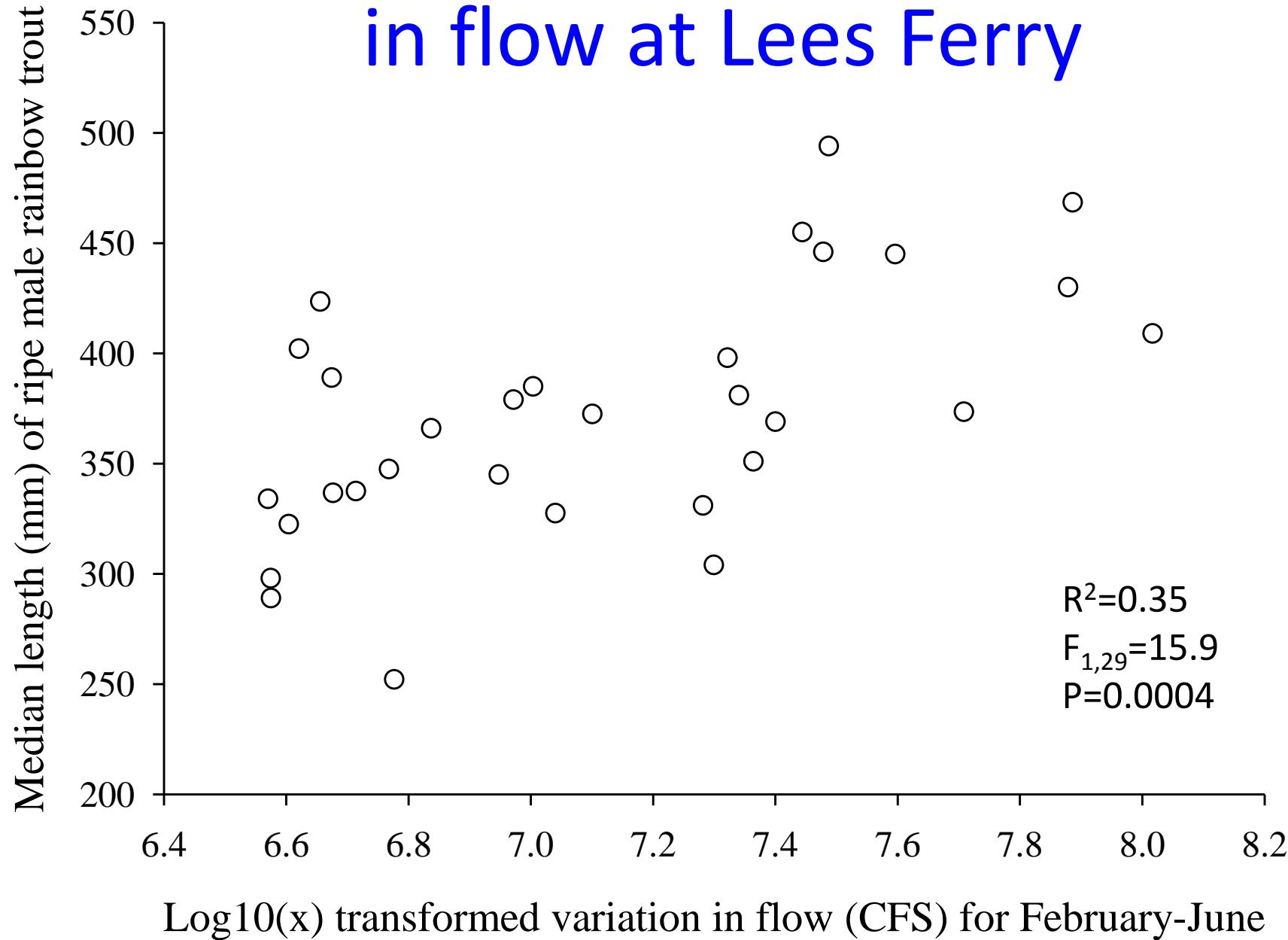




# Boat angler CPUE and variance in flows (Feb.-June)



# Size at reproduction and variation in flow at Lees Ferry



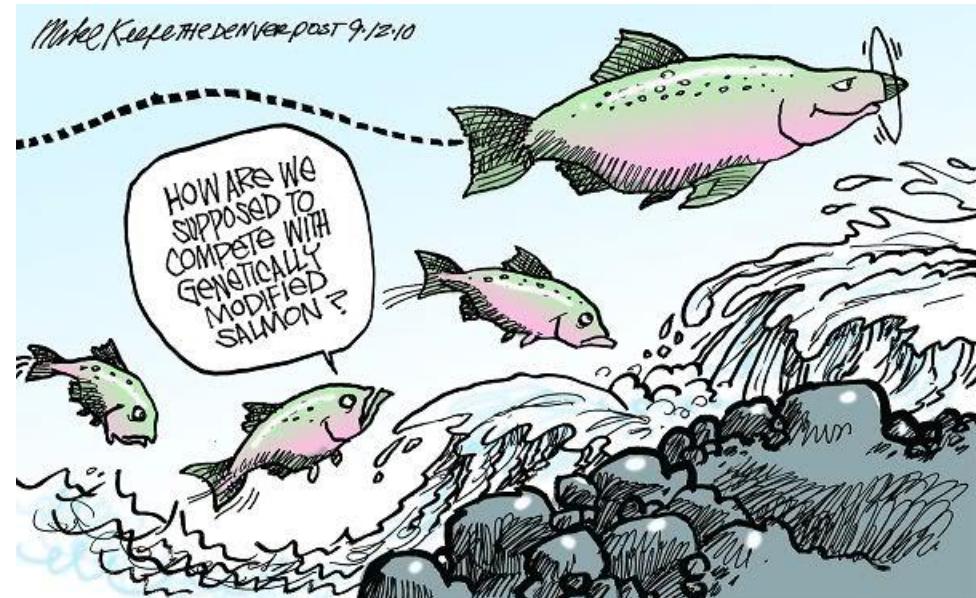
# What can be done?

- If you want larger fish...
  - Stock fish
    - Triploids
    - Different strains
  - **change the selection pressure**
    - How? Is it possible?
    - Larger fish that reproduce at larger size:
      - difficult in an aquaculture and laboratory setting, let alone in a river

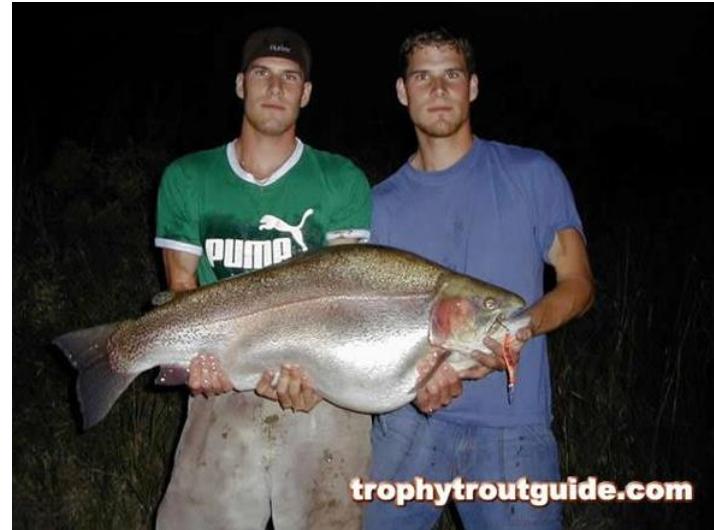


# Stocking

- Triploids vs. diploids
  - Most studies showed no difference or less growth or size in actual field studies comparing triploid and haploid (normal) rainbow trout
  - Usually higher catch rates (creel returns) for triploids
- Different strains
  - Laboratory and aquaculture studies not very conclusive



If you want  
larger fish at Lees Ferry!



- **Change selection pressure** on life history characteristics
  - Optimize selection so that larger and older fish have an evolutionary advantage



# How to change the selective pressure?

- Selection for fish to live longer and mature later (larger size)
  - Increase mortality of juveniles
    - Predators
    - Modification of flows
  - Increase variation in reproductive success

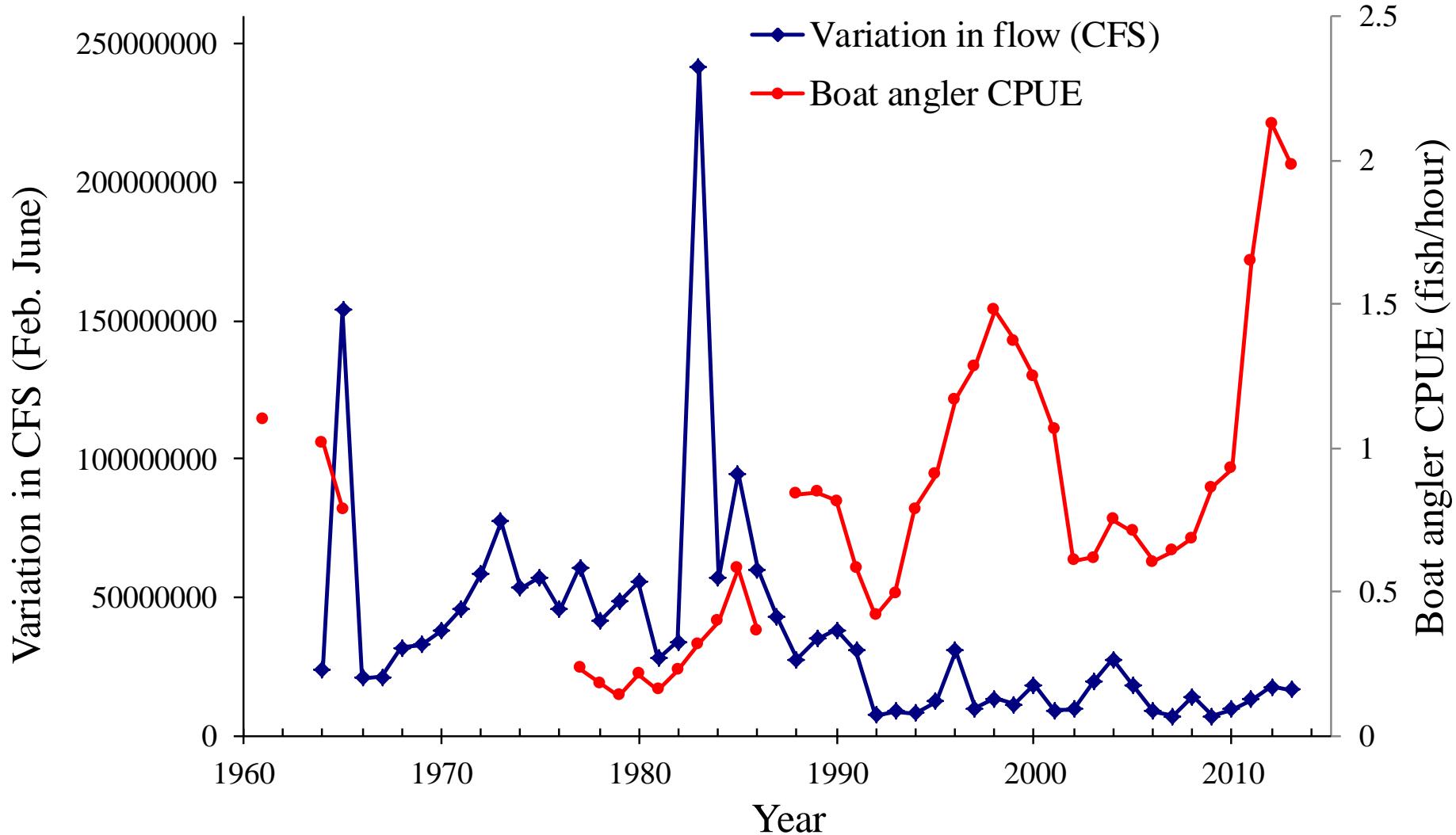


# Downsides

- Daily variation in flows back to historical levels (range of 15-25,000 cfs per day) during spawning season? **NOT LIKELY**
- Less fish (lower CPUE): most anglers want to catch more fish than a few large fish.



# Boat angler CPUE and variance in flows (Feb.-June)





# Acknowledgements

- AZGFD: B. Stewart, L. Winters, R. Osterhoudt, P. Wolters, K. Manuell, A. Bunch, M. Anderson, D. Peterson, A. Makinster, S. Rogers, W. Lemon, R. Fullmuth, M. Mishler, and many others...
- USGS-Grand Canyon Monitoring and Research Center (GCMRC)
- Numerous volunteers
- Numerous boatmen:
  - USGS-GCMRC
  - Humphrey's Summit
  - St. Judes LLC.
- Steve Harding

A fly fisherman stands in a shallow, brownish river, casting his green fly line upstream. He is wearing a yellow cap, a dark long-sleeved shirt, and tan waders. The river flows through a landscape of red rock cliffs and green shrubs under a clear blue sky.

Questions?

# Variation in flow related to boat angler CPUE

